

Calorimetry

- A calorimeter is a device used to measure changes in thermal energy
- Change in water temperature allows us to calculate change in thermal energy

Example:

A 0.500kg sample of water in a calorimeter is at 15 ° C. A 0.0400 kg block of zinc at 115 ° C is placed in the water. The specific heat of zinc is 388J/kg ° C. Find the final temperature of the system.

$$\begin{aligned}
 E_{hw} &= -E_{hz} \\
 mc\Delta T &= -mc\Delta T \\
 (0.5\text{kg})(4.18\frac{\text{J}}{\text{kg}\cdot\text{C}})(T_f - 15) &= -(0.04\text{kg})(388\frac{\text{J}}{\text{kg}\cdot\text{C}})(T_f - 115)
 \end{aligned}$$

$$\begin{aligned}
 &= -(0.04 \text{ kg})(388 \frac{\text{J}}{\text{kg}^\circ\text{C}})(T_f - 115) \\
 2090T_f - 31350 &= -15.5T_f + 1785 \\
 2105.5T_f &= 33135 \\
 T_f &= 15.7^\circ\text{C}
 \end{aligned}$$

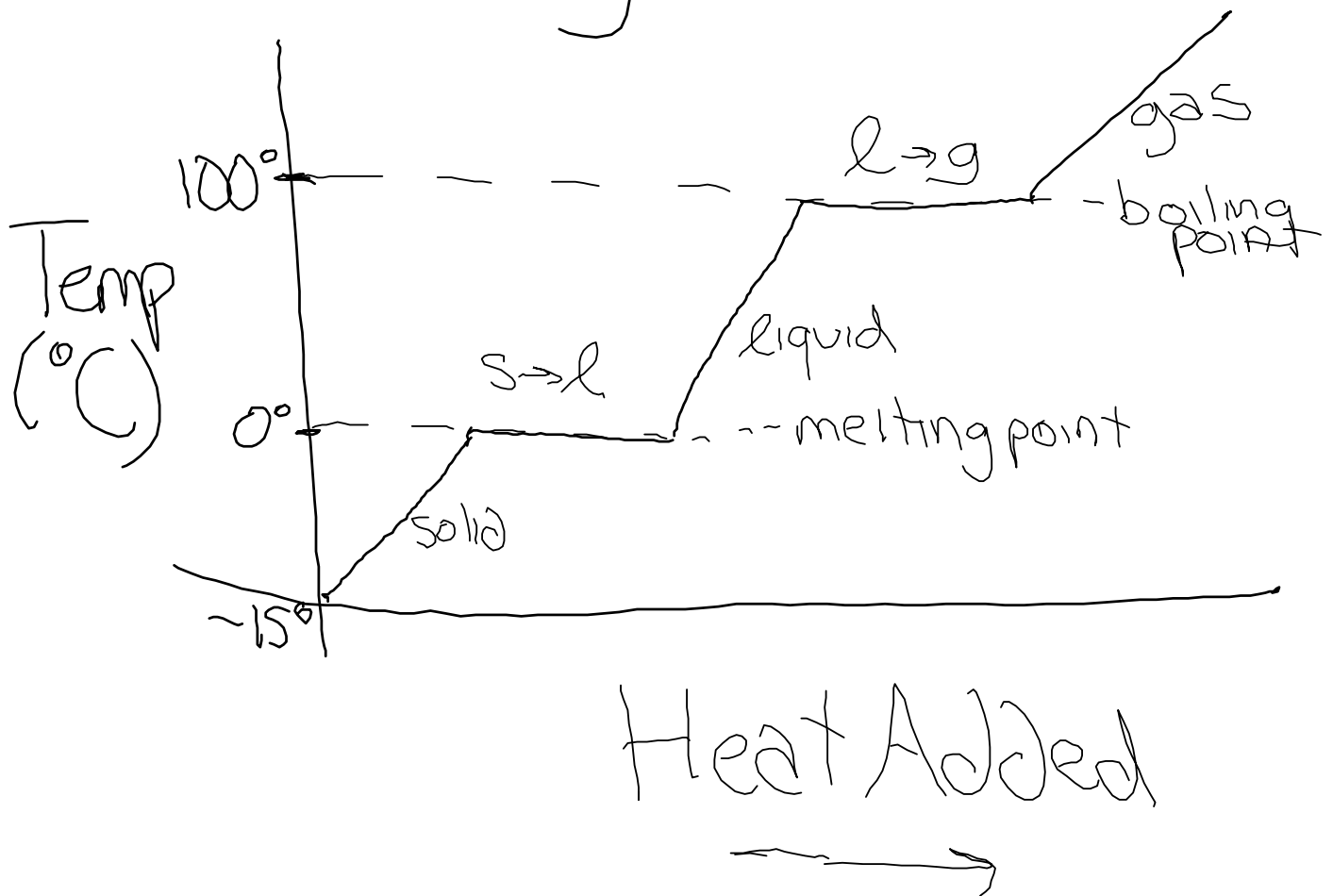
Example 2: A 100g block of aluminum at 100°C is placed in 100g of water at 10°C . The final temperature of the mixture is 25°C . What is the specific heat of aluminum as determined by the experiment?

$$\begin{aligned}
 -E_{hAl} &= E_{hw} \\
 -mc\Delta T &= mc\Delta T \\
 -(100\text{g})C_{Al}(25-100) &= (100\text{g})(4.18\text{J}/(\text{g}^\circ\text{C}))(25-10)
 \end{aligned}$$

$$-100\text{g}(-75^\circ\text{C}) C_{AI} = 6270\text{J/g}$$

$$C_{AI} = 0.836\frac{\text{J}}{\text{g}^\circ\text{C}}$$

Heating Curves



Heating curves

- Temperature does NOT change during a phase transition (flat parts of graph)

Melting point

- Temperature at which substance changes from solid to liquid
- Forces between particles cannot hold them and they slide past each other
- Added energy BREAKS BONDS, does not increase temperature

Boiling Point

- Temperature at which substance changes from liquid to gas
- Particles have enough energy to break away from their neighbours
- Added energy BREAKS BONDS, does not increase temperature